Empirical Assessment of the Nexus between Industrialization and Economic Growth of Nations: The African Perspective

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ABSTRACT

The study examined the relationship between industrialization and the level of economic growth among nations in Africa from year 2013 to 2019. The study categorized African nations into five top industrialized nations and five least industrialized nations. Economic growth was proxy using Gross Domestic Product (GDP) and Per capita Gross Domestic Product (GDP). Time series data on national GDP, population and level of industrialization were obtained from International Monetary Fund statistical data, the Worldometer and United Nation Industrial Development Organization (UNIDO). By deploying the correlation statistics and t-test aided by SPSS version 20, the study tested if there was any significant relationship between the mean GDP of the top five industrialized nations and the mean GDP of the least five industrialized nations. It further tested if there was any significance relation between the mean per capita GDP of the top five industrialized nations and the mean per capita GDP of the least five industrialized nations. Findings showed a high correlation between the mean GDP of the top five industrialized nations and the mean GDP of the least five industrialized nations. Again it was found that there is significance relationship between the mean per capita GDP of the top five industrialized nations and the mean per capita GDP of the least five industrialized nations. As both GDP and per capita GDP of both industrialized and least industrialized nations move in the same direction regardless of the level of industrialization, the study concluded that industrialization is yet to a significant relationship between GDP and per capita GDP of African nations. It was recommended, among other things, that African nations should make and implement policies that will unlock the effect of industrialization on the level of their GDPs and per capita GDPs.

INTRODUCTION

A nation's economy is characterized by the activities being carried on in the nation towards the production of goods and services to meet both the immediate and future needs of the citizens. Mining, oil and gas, agriculture, manufacturing, human capital development, health care facilities, rural and urban electrification and so forth form part of the economic activities of a nation. The extent to which the economic activities are carried out in a country and the impact it has on the living standard of the citizen has remained a deciding factor as to the level of development placed on that particular country (Gui-Diby and Renard, 2015). Thus countries around the world are classified as developed, developing or underdeveloped based on how well they are able to harness their resources in archiving greater output.

Research has shown that industrialization is the bedrock of economic development which is translated into economic diversification, unemployment reduction, human capital development, technology transfer, low inflation rate and welfare improvement (Beji & Belhadj, 2016). The top ten economies in the world are highly industrialized economies, they are the United States of America nominal with GDP of $21.43 trillion, and GDP per capita of $65,298, China nominal with GDP of $14.34 trillion, and GDP per capita of $10,262 and Japan nominal with GDP of $5.08 trillion, and GDP per capita of $40,247. Others

are Germany with nominal GDP of $3.86 trillion, and GDP per capita of $46,446, India with nominal GDP of $2.87 trillion, and GDP per capita of $2,100, United Kingdom with nominal GDP of $2.83 trillion, and GDP per capita of $42,330, France with nominal GDP of $2.72 trillion, and GDP per capita of $40,493, Italy with nominal GDP of $2.00 trillion, and GDP per capita of $33,228, Brazil with nominal GDP of $1.84 trillion, and GDP per capita of $8,717 and Canada with nominal GDP of $1.74 trillion, and GDP per capita of $46,195 all as at 2019.

A careful analysis of the most industrialized economies of the world showed that no African nation made the list and this amount to something to worry about. Nigeria ranked as the largest economy in Africa, followed by South Africa, Egypt, Algeria and Morocco (African Development Bank, 2020). The African Centre for Economic Transformation (2014) pointed out that even though some steady growth was recorded among African nations since the mid 1990s, they still find it very difficult to ensure that such growth is translated into development policies and plans that are sustainable. Studies have shown that the continent Africa is the least industrialized region of the world, while the share of sub-Saharan Africa (SSA) in global manufacturing value added actually declined in most sectors between 1990 and 2000 (Darla & Ivan, 2009). As succinctly put by Lall & Wangwe (1998), in Africa the developmental contribution of the industrial sector is well below its potential.

The African Centre for Economic Transformation, (2014) and Benneth, Anyanwu & Kalu, (2015) asserted that most of the African countries have relied excessively on low-productivity agriculture, and thus failed to develop strong manufacturing industries. Nzau (2010) maintained that bad political culture, weak political and social institutions, poor leadership and bad governance seem to have contributed to this failure from within.

African countries are majorly classified as under developed while just few fell under the category of developing economies. Thus determination of whether African economies are factors of industrialization which is largely believed to be the mover of sustainable economic development now becomes very important.

Objective of the study
This research is aimed at assessing the relationship between industrialization and economic growth in Africa

The specific objectives are:
1. To assess the mean Gross Domestic Products of industrialized nations and the mean Gross

Domestic Product of least industrialized nations in Africa with a view to determine the type of relationship that exist between them
2. To appraise the mean Gross Domestic Products per capita of industrialized nations and the mean Gross Domestic Product per capita of least industrialized nations in Africa and determine the relationship that exist between them

Consequently the following hypotheses shall be tested

Research Hypothesis
Ho: The industrial sector contribution has no significant relationship between Gross Domestic Product and African economy.

Ho: The industrial sector contribution has no significant relationship between per capita Gross Domestic Product and African economy.

Conceptual Framework
Efobi, U. R, Asongu, S, Okafor C, Tchanyou v, s & Tanankem B (2019), views industrialization as a socio-economic process of quick transformation within the manufacturing sector in relation to a plethora of avenues of production and work done within an economy. It encompasses the added value of the manufacturing sector when the overall size of the economy is considered. Gui-Diby and Renard (2015), have in their work, maintained that when the level of development in the manufacturing sector is comparatively high with regard to other sectors within an economy, the industrialization rate in the country is also relatively high. As manufacturing has a greater capacity to absorb labour force (Timmer, 2015), opined that industrialization promotes savings, boosts the process of capital accumulation and offers higher investment opportunities.

Manaufacturing sector of the economy deals with the production of various goods, both consumers goods and industrial goods. We cannot fully discuss industrialization without the mention of manufacturing sector of the economy. Extant literatures have shown that the manufacturing sector promotes economies of scale by driving technological progress while providing spillover effects through linkages to other economic sectors (Hirschman, 1958 and Thirlwall, 2002 cited in Bruna & Macro, 2017). It is believed to be the forerunner to industrialization (Mike Morris & Judith Fessehaie (2014).

It must be noted however that the mover of industrialization is not limited to manufacturing alone as the service industries also play important role. The service sector of the economy deals with provision of services that contribute to economic growth and development of the nation. The Gross Domestic Product (GDP) is the increase in the amount of fund

accrued to a nation without any reference to the purchasing power. Gross Domestic Product, according to the National Bureau of Statistics (2012), is the market value of all officially recognized final goods and services produced within a country in a year. It is the standard indicator for measuring the value placed on the economy of a country (Ezeala G. & Obi J. O, 2022). The GDP is the most widely acceptable statistical indicator of national growth. While economic growth is viewed as increase in a nation's Gross Domestic Product (GDP) over a specified period of time, economic development is seen as increase in Gross Domestic Product resulting from sustainable industrialization. Manufacturing industries and service industries are all inclusive. Gross Domestic Product per capita is the ratio of GDP to the total population of the nation. It is also called the mean standard of living of the people because it is used to measure how much of the national wealth is attributable to one individual resident in the country.

Review of Related Literature

While some studies concluded that industrialization has some significant effect on nations economic growth, others maintained that industrialization has no effect and in some cases negative effect on economic growth. Nwogo, J. E., Orji, J. O. (2019) assessed the extent to which crude petroleum, natural gas and solid mineral mining output have impacted on economic growth in Nigeria. Using the vector error correction and system equation estimation technique for data analysis, they concluded that manufacturing sector output, crude petroleum and natural gas output, and solid mineral and mining output have some significant effect on the real gross domestic product in Nigeria. Mandara & Ali (2018) in their study examined the impact of industrialization on economic growth in Nigeria for the period spanning from 1981 to 2015. Secondary data was sourced from the Central Bank of Nigeria's statistical bulletin and was analyzed through the employment of Augmented Dickey Fuller regression. Their result from the ARDL regression showed a positive and significant impact between industrial output and gross domestic product. Hogen, Mensah & Sen (2022) assessed industrialization in developing countries from 1990 to 2018. Time series data on annual data of employment, real and nominal value added by 12 sectors in 51 economies were obtained. Findings from the analysis showed that there exist some level of industrialization in many low-income Asian and sub-Saharan African countries. Again it was further found that the industrial naissance in sub-Saharan Africa was characterized by unregistered firms that expand employment. They concluded that industrialization is

not largely driven by firm whether registered or unregistered. Study conducted by Beji & Belhadj (2016) assessed the determinant of industrialization in Africa. Their scope of study covered period from 1970 to 2012 with 35 African countries as case study. Researchers obtained time series data on Foreign Direct Investment, Labour Market Rigidity index, Real Effective Exchange Rate, Gross Domestic Product Par Capita, Human Capita Indicator and Financial Development Indicator. Data on the above mentioned variables were regressed with Industry Value Added as a share of GDP. To check the robustness of their results, they again conduct another test based on sub-regional and sub-period analysis. Findings from their study showed that: (i) Human capital, Labor Market conditions, Real Effective Exchange Rate and GDP per capita are clear determinants of industrialization in Africa; (ii) The determinants of industrialization vary between regions in the continent and evolve over time; (iii) policy interdependencies are significant and positive for industrialization in Africa.

Others studies concluded that industrialization has not really made any significant impact on nations' economic growth. Benneth, Anyawu & Kalu (2015) assessed the effect of Industrial Development on Economic Growth in Nigeria from 1973 to2013. Using GDP to proxy economic growth and foreign direct investment, industrial output, total savings and inflation to proxy industrialization, they concluded that the influence of industrial output on economic growth in Nigeria is not statistically significant. Similarly, an earlier study by Ughulu S. E (2021) had concluded that industrial sector output has a negligible effect on economic growth in Nigeria and therefore called on the government for appropriate policy implementation that would strengthen the industrial sector activities in Nigeria so as to promote the effect of industrial sector output growth on the nation's economy. Sutikno & Mohammad (2017) examined the impact of industrialization on the regional economic development. Being one of the largest industries in East Java, the researchers chose Gresik regency as the research setting. Regression analysis was employed to determine the impact of industrialization on economic growth, unemployment, and poverty. Again researchers employed Confirmatory Factor Analysis (CFA) to investigate the impact of industrialization on the community welfare and finally Monte Carlo simulation was used to formulate a recommendation. The result showed that the industrialization in Gresik still has not been able to give extensive significant impact for the community in Gresik regency and its existence can only be enjoyed by nearby residents. Again, Aliya &

Odoh (2016) in their study examined the impact of industrialization in Nigeria. They proxy the dependent variable using the Gross Domestic Product (GDP) and the independent variables using the Agricultural sector, Industrial sector and Services sector. In their study, they analyzed the relationship between Gross Domestic Product and Agricultural sector, Industrial sector and Services sector in Nigeria. Causality test result showed a bidirectional causal relationship between GDP, AR, ID and SV. They concluded that (1) industrialization is influenced by agricultural output (2) The performance of agricultural sector in Nigeria is currently below expectation. They suggested that the agricultural sector be developed to provide the needed support to the industrial and services sectors. It was hoped that such strategy will encourage the development and economic growth of a developing country.

Bruno Martorano, Marco Sanfilippo & Nobuya Haraguchi (2017) reviewed the drivers of successful industrialization in developing countries between two deferent periods 1970-1990 and 1991-2014 which they considered to be likely affected by different patterns of industrialization due to major political, technological and organizational changes. They develop a simple methodology to identify a small group of countries for each period, which have exhibited a pattern of industrialization that is not only remarkable in absolute terms, but also sustained (i.e. industrialization that occurs over a long period of time). Time series data on Real Gross Domestic Product (GDP) per capita, manufacturing value added (MVA), Gross fixed capital formation and Real effective exchange rate of respective countries in Africa was obtained from the UN National Accounts Statistics and World Development Indicators Data base. Using regression analysis, they concluded that that (1) industrialization is driven by a combination of factors, including initial economic conditions, factor endowments, as well as country characteristics such as demographic structure and geography. They further claimed that countries with a lower level of income per capita are those that are more likely to embark on a path of sustained industrialization, and are thus more likely to still be specialized in industries with low productivity growth, a fact that is consistent with basic theories of structural transformation. (2) Industrialization is also driven by other country-specific factors such as demographics and geographic conditions with particular emphasis on demographic as studies have shown that over time, countries that industrialized were those that benefited from 'demographic windows' (3) Factor endowments clearly play a key role in the level of industrialization of a nation. Their study showed that industrialization

is more likely to be successful in countries with low labour costs and less likely in resource rich economies since they affect a country's comparative advantage and its pattern of development. Carlos Humberto Ortiz1 Javier Andrés Castro2 Erika Raquel Badillo3 (2009) carried out a research on which they titled Industrialization and Growth: Threshold Effects of Technological Integration. Using Regression analysis to test research hypotheses, they concluded that (1) Economic growth is not significantly correlated with educational attainment when one controls for technological integration in the manufacturing sector (2) a strong positive correlation between education and the measures of overall linkages thus revealed education as a necessary but not sufficient condition for economic growth. Jelilov, Enwerem & Isik (2016) assessed the Impact of Industrialization on Economic Growth: The Nigeria Experience (2000-2013). They specified their model which has GDP as the dependent variable while industrial output, foreign direct investment, interest rate, foreign exchange rate and inflation rate were taken to be the independent variables. Secondary data obtained from the Central Bank of Nigeria Statistical Bulletin and the Nigerian National Bureau of Statistics were analyzed using Ordinary least square (OLS) technique. The study revealed that industrialization has a negative impact on economic growth in Nigeria in the long run. They therefore recommended amongst others, that the government should redirect its industrial and investment policy so as to increase output of the domestic production (RGDP), flexible exchange rate and control inflation rate since that showed that increase in exchange and inflation rate, decreased output, industrial and investment policy should be flexible on infant industries so as to encourage productivity and improve GDP.

Research Methodology

We employed ex-post facto design for this study. The ex-post-facto research design deals with providing explanations to events that already existed. Time series data on Gross Domestic Product (GDP) as well as Gross Domestic product per Capita (GDP PER CAPITA) for both the industrialized and less industrialized nations in Africa was obtained from International Monetary Fund World Economic Outlook and the data is presented under appendix 1, 2 and 3 below. Our analysis was to determine whether there is any significant difference between the mean score of the industrialized nations and the mean score of the less industrialized counterparts from year 2013 to 2019. Ordinary least square correlation analytical tool was used in analyzing the data with the aid of SPSS.

Model Specification

The ordinary least square correlation econometric model for the study is stated below

$Y = \beta_0 + \beta_1 X_1 + e_i \ldots\ldots\ldots$ (1)

Where Y = population mean of top industrialized nations in Africa

X = population mean of top less industrialized nations in Africa

$\beta_0 + \beta_1$ = correlation coefficients

e_i = error term

Hypothesis one

Ho: There is no significant relation between industrialization and Gross Domestic Product in African economy

Mean GDP of top industrialized nations in Africa (X)	Mean GDP of top least industrialized nations in Africa (Y)
232,630,120.00	13,514,769.60
241,336,220.00	14,752,382.20
248,221,000.00	16,132,160.20
250,581,180.00	17,235,421.80
255,542,620.00	18,807,307.80
261,634,200.00	20,121,000.00
279,891,800.00	22,598,200.00

Author's computation from data in appendix 1

CORRELATIONS

/VARIABLES=Y X

/PRINT=TWOTAIL NOSIG

/MISSING=PAIRWISE.

Correlations		Y	X
Y	Pearson Correlation	1	.985**
	Sig. (2-tailed)		.000
	N	7	7
X	Pearson Correlation	.985**	1
	Sig. (2-tailed)	.000	
	N	7	7
**. Correlation is significant at the 0.01 level (2-tailed).			

T-Test

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	X	252833877.1429	7	15185823.22439	5739701.67222
	Y	17594463.0857	7	3159122.43248	1194036.04536

Paired Samples Correlations		N	Correlation	Sig.
Pair 1	X & Y	7	.985	.000

Paired Samples Test									
		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	X - Y	235239414.05714	12085816.05803	4568009.09726	224061898.46092	246416929.65336	51.497	6	.000

Hypothesis two

Ho: There is no significant relation between industrialization and per capita Gross Domestic Product in African economy.

Mean GDP per capita of top industrialized nations in Africa (X)	Mean GDP per capita of top least industrialized nations in Africa (Y)
3.428	0.532
3.58	0.546
3.626	0.566
3.622	0.578
3.642	0.600
3.666	0.616
3.726	0.654

Author's computation from data in appendix 2and 3

CORRELATIONS
    /VARIABLES=Y X
    /PRINT=TWOTAIL NOSIG
    /MISSING=PAIRWISE.

Correlations		X	Y
X	Pearson Correlation	1	.876**
	Sig. (2-tailed)		.010
	N	7	7
Y	Pearson Correlation	.876**	1
	Sig. (2-tailed)	.010	
	N	7	7

**. Correlation is significant at the 0.01 level (2-tailed).

T-Test
[DataSet0]

Paired Samples Statistics		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	X	3.6129	7	.09308	.03518
	Y	.5846	7	.04220	.01595

Paired Samples Correlations		N	Correlation	Sig.
Pair 1	X & Y	7	.876	.010

Paired Samples Test									
		Paired Differences							
					95% Confidence Interval of the Difference				Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper	t	df	
Pair 1	X - Y	3.02829	.05966	.02255	2.97311	3.08346	134.297	6	.000

Discussion of findings

With reference to analysis of hypothesis one above, the correlation table showed that the two variables X and Y have a correlation of 0.985 with each other. This indicates a very high positive relationship between the mean GDP of top five industrialized nation and the mean GDP of least five industrialized nations in Africa. Further analysis to ascertain if this position happened by chance was conducted as shown in the t-test. From the paired sample table, t-value of 51.497 was obtained indicating that the position from the correlation table is repeatable for the entire population, thus did not occur by chance. This is further confirmed by the P-value of 0.000 implying 0.00% possibility that the very high positive relationship between variables happened by chance. Based on the above, we accept the alternative hypothesis we accept the alternative hypothesis which states that there is significant relationship between the GDP of industrialized nations and the GDP of least industrialized nations in Africa.

In hypothesis two, the correlation table showed a correlation of 0.876 between the variables, indicating high relationship between the mean GDP per capita of top industrialized nation and the mean GDP per capita

of least industrialized nations in Africa. The paired sample table from the t-test showed a t-value of 134.297 which indicates that the position from the correlation table could represent the entire population. Finally, the P-value of 0.000 corroborated this position by asserting that the relationship between the two variables did not happen by chance and could statistically represent the entire population. We therefore accept the alternative hypothesis which states that there is significant relationship between the GDP per capita of industrialized nations and the GDP per capita of least industrialized nations in Africa.

Summary and Conclusion

Based on the analysis above, as the GDP of industrialized nations increase, the GDP of the least industrialized nations increase too. This indicates that the GDPs of both industrialized and least industrialized nation in Africa are moving in the same direction regardless of whether the country is industrialized or not. Haven establish this fact, we therefore conclude that industrialization has not yet made any significant impact on the level of GDP of nations in Africa.

In the same way, when the GDP per capita of industrialized nations increase, the GDP per capita of the least industrialized nations also increase in the same direction, an indication that the direction of the GDP per capita is not influenced by whether the nation is industrialized or not. Based on the above, we conclude that industrialization has no significant relationship between the GDP per capita and nations in Africa. According to Nzau (2010) bad political culture, weak political and social institutions, poor leadership and bad governance seem to have contributed to the failure of African nations to feel the impact of industrialization within its economies.

Recommendation

African nations should make and implement policies that will unlock the effect of industrialization on the level of their GDPs and GDPs per capita. To achieve this, there should be policies targeted at eliminating corruption and other irregularities in public and private establishments which may have eroded the potential effect of industrialization.

Again, government should promote policies that encourage declaration of accurate figures of economic activities by industries. This will enable government to document accurate figures about economic activities that are going on within the nation. This is in tandem to the findings in Hogen, Mensah & Sen (2022), that many industrial activities going on in Africa are not registered.

More so, African nations should pursue policies and programs towards achieving population control and healthy leaving. This will enhance the level of GDP per capita and promote leaving standard of the nations.

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Appendixes i
GDP in thousand Dollars of top industrialized nations in Africa from 2013 to 2029

	2013	2014	2015	2016	2017	2018	2019
Nigeria	361,014,900.00	383,794,900.00	393,965,500.00	387,583,300.00	390,761,500.00	398,186,000.00	446,543,000.00
South Africa	347,799,800.00	354,234,100.00	358,768,300.00	360,813,300.00	365,576,000.00	368,135,000.00	358,839,000.00
Egypt	202,951,700.00	208,877,800.00	218,005,800.00	227,489,100.00	236,998,100.00	249,559,000.00	302,256,000.00
Algeria	149,834,500.00	155,513,200.00	161,360,500.00	166,685,400.00	169,519,000.00	173,757,000.00	172,781,000.00
Morocco	101,549,700.00	104,261,100.00	109,004,900.00	110,334,800.00	114,858,500.00	118,534,000.00	119,040,000.00
	1,163,150,600.00	1,206,681,100.00	1,241,105,000.00	1,252,905,900.00	1,277,713,100.00	1,308,171,000.00	1,399,459,000.00

Source: international monetary fund

Appendix ii
GDP in thousand Dollars of least industrialized nations in Africa from 2013 to 2029

	2013	2014	2015	2016	2017	2018	2019
Gambia	1,384,717.00	1,397,180.00	1,457,258.00	1,489,609.00	1,541,746.00	1,625,000.00	1,773,000.00
Malawi	5,768,610.00	6,097,420.00	6,268,148.00	6,423,598.00	6,680,542.00	6,901,000.00	7,522,000.00
Car	1,893,523.00	1,913,216.00	2,005,050.00	2,095,879.00	2,186,002.00	2,280,000.00	2,321,000.00
Ethiopia	51,793,430.00	57,107,430.00	63,040,900.00	67,806,790.00	74,756,980.00	80,289,000.00	91,166,000.00
Rwanda	6,733,568.00	7,246,665.00	7,889,445.00	8,361,233.00	8,871,269.00	9,510,000.00	10,209,000.00

Source: international monetary fund

Appendix iii
Population

	2013	2014	2015	2016	2017	2018	2019
Nigeria	172,473,565.98	176,923,383.98	181,488,007.28	186,170,397.87	190,973,594.14	195,900,712.87	200,954,951.26
South Africa	54,256,588.47	54,951,072.80	55,654,446.53	56,366,823.45	57,088,318.79	57,819,049.27	58,559,133.10
Egypt	89,455,955.69	91,191,401.23	92,960,514.41	94,763,948.39	96,602,368.99	98,476,454.95	100,386,898.18
Algeria	38,570,272.23	39,283,822.26	40,010,572.97	40,750,768.57	41,504,657.79	42,272,493.96	43,054,535.10
Morocco	33,953,695.28	34,361,139.63	34,773,473.30	35,190,754.98	35,613,044.04	36,040,400.57	36,472,885.38
Gambia	1,973,003.45	2,031,009.75	2,090,721.44	2,152,188.65	2,215,462.99	2,280,597.60	2,347,647.17
Malawi	15,886,082.12	16,313,417.73	16,752,248.67	17,202,884.16	17,665,641.74	18,140,847.51	18,628,836.30
Car	4,268,630.02	4,344,611.64	4,421,945.72	4,500,656.36	4,580,768.04	4,662,305.71	4,745,294.75
Ethiopia	96,253,786.03	98,727,508.34	101,264,805.30	103,867,310.80	106,536,700.68	109,274,693.89	112,083,053.52
Rwanda	10,836,905.40	11,116,497.56	11,403,303.20	11,697,508.42	11,999,304.14	12,308,886.19	12,626,455.45

Source: Worldometer (www.Worldometers.info)